

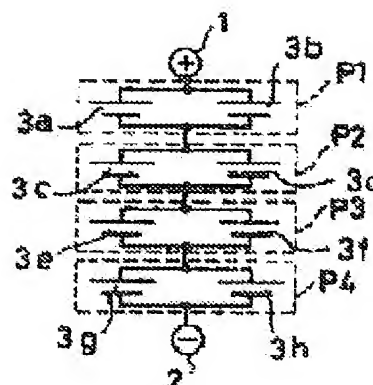
BATTERY

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PURPOSE: To obtain a set battery of connected non-aqueous secondary cells, which can have its charging/discharging cycle lifetime come close to that of one formed all of normal cells even if an abnormal cell is mixed, by connecting the cells mutually in a specified method. **CONSTITUTION:** A set battery is formed by connecting units of non-aqueous secondary battery using carbonaceous material, which is obtained by doping or undoping lithium ion, as the negative electrode active material, and in this battery, the following connecting method is used: plural pairs of parallel connection of unit, which does not includes the series connection part, (for example, P1-P4) are connected in series.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] In this invention, it is related with a nonaqueous secondary battery. Therefore, it is related with the cell group of a nonaqueous secondary battery in more detail.

[0002]

[Description of the Prior Art] As a noncommercial small rechargeable battery, although there are a nickel cadmium battery, a nickel hydrogen storage battery, etc. conventionally, In recent years, when attaining the miniaturization of electronic equipment of a battery drive with comparatively large power consumption, such as a personal computer of a note type, a word processor, a portable video camera, a cordless telephone, and a weight saving, high-capacity-izing of the rechargeable battery which is a power supply, and high-tension-ization are demanded. then, also in the rechargeable battery, a dope and the nonaqueous secondary battery which can be dedoped boil a lithium ion markedly in respect of a light weight, high capacity, and high tension, it excels, and a request is high as a power supply of the above-mentioned electronic equipment. To electronic equipment with larger power consumption, the item (it is henceforth described as a cell) of this cell is corresponded with series or the cell group which connected in parallel and increased voltage and electric capacity. [two or more]

[0003] The conventional composition of the cell group which comprises both the portion which carried out the series connection of the cell among this cell group, and the portion which carried out multiple connection, Set the positive pole terminal for presenting charge and discharge with it, if drawing 2 shows the combination composition of 4 series and 2 parallel to an example to 11, and a negative pole terminal is set to 12, Multiple connection of the series-connection group S1 which comprises the cells 13a, 13b, 13c, and 13d, and the series-connection group S2 which comprises the cells 13e, 13f, 13g, and 13h was carried out. That is, multiple connection of the plurality of the series-connection group which does not contain a multiple connection portion was carried out, and it was considered as the cell group.

[0004]

[Problem(s) to be Solved by the Invention] cell 13a However, in the above-mentioned conventional composition, drawing 2 accepts it, for example, As compared with other cells, open circuit voltage is low or internal resistance by causes, like it is high When initial service capacity is low, Or when a charging and

discharging cycle advances and the service capacity of an early stage to the cell 13a becomes low rapidly, Or if a charging and discharging cycle is carried out between lower limit voltage and upper limit voltage predetermined [to a cell group] when the cell in which low service capacity is shown as the cell 13a is intermingled (the cell of an unusual article and others is henceforth described for such a cell as a normal article), the following technical problems will occur.

[0005]First, since discharge voltage falls more quickly than a normal article, overdischarge of the unusual article 13a is carried out exceeding the lower limit voltage per cell (the lower limit voltage / in-series number to a cell group), as discharge advances. On the other hand, since it is going to discharge the unusual article 13a and the normal article 13b, 13c, and 13d which has an in-series relation to the lower limit voltage to a cell group on the voltage of the S1 whole, it does not discharge only the part in which the unusual article 13a carried out overdischarge to the lower limit voltage per cell. That is, it will be in an imperfect discharge state.

[0006]Then, if charge advances, in order that internal resistance may rise by having carried out overdischarge or the unusual article 13a may receive a damage in positive active material, the acceptance nature of charging capacity is reduced. Therefore, even if it charges with the current, the attainment to the upper limit voltage per cell (the upper limit voltage / in-series number to a cell group) speeds up from a normal article, but. It charges exceeding the upper limit voltage per cell, and the unusual article 13a is overcharged in potential until the voltage of the S1 whole reaches to the upper limit voltage to a cell group. On the other hand, since the normal article 13b, 13c, and 13d tends to be charged to the upper limit voltage to a cell group on the voltage of the S1 whole, only a part for the unusual article 13a to have overcharged in potential is not charged to the upper limit voltage per cell. That is, it will be in an imperfect charging state in potential. Service capacity is reduced in order that the unusual article 13a may receive a damage in negative electrode active material by having overcharged in potential.

[0007]Therefore, since the overdischarge depth of the unusual article 13a and overcharge depth increase so that a charging and discharging cycle advances, a charge-and-discharge cycle life is contracted remarkably. And although S2 which also contracts remarkably the charge-and-discharge cycle life of the aSunusual article 131 whole, and is carrying out multiple connection to S1 equalizes service capacity mutually, The voltage difference and the service capacity difference of the unusual article 13a and the normal article 13b, 13c, and 13d always do not contract during charging and discharging cycle advance, and even before starting a charging and discharging cycle, it is taken and expanded to advance of the charging and discharging cycle. Although S1 and S2 are carrying out multiple connection therefore, the charge-and-discharge cycle life will be remarkably contracted also as the whole cell group.

[0008]Then, the purpose of this invention solves such a technical problem, and provides the cell group which can be made to approach the charge-and-discharge cycle life of the cell group which also comprises a charge-and-discharge cycle life when the above unusual articles are intermingled in the total normal article.

[0009]

[Means for Solving the Problem]In order to solve this technical problem, a cell group of this invention, It is a cell group which connects an item of a nonaqueous secondary battery [lithium ion] using a dope and a carbonaceous material which can be dedoped as a negative electrode, and has the composition carrying out the series connection of the plurality of a multiple connection group of said item which does not contain

a series connection part.

[0010]

[Function] Since according to the cell group of this invention multiple connection is carried out to the normal article even if one in a cell is an unusual article, Since electrical properties, such as open circuit voltage of all the cells of this multiple connection group, internal resistance, and service capacity, are averaged mutually and equalized, voltage difference and a service capacity difference are always zero also during charging and discharging cycle advance, even before starting a charging and discharging cycle. Since it was averaged, although service capacity falls rather than other multiple connection groups which comprise only a normal article, this multiple connection group, Since it decreases so that a part for this fall has more cells of a multiple connection group in the series-connection group containing the conventional unusual article than a fallen part to the normal article of an unusual article, it can make depth of the overdischarge and the surcharge of an unusual article shallower than before. Therefore, the charge-and-discharge cycle life of the multiple connection group containing an unusual article is prolonged more remarkably than the charge-and-discharge cycle life of the series-connection group containing the conventional unusual article. Therefore, even when an unusual article is intermingled, the charge-and-discharge cycle life of the whole cell group can be prolonged conventionally, and the charge-and-discharge cycle life of the cell group which comprises only a normal article can be made to approach.

[0011]

[Example] Drawing 1 shows 4 serial x2 parallel to an example about the example of this invention below.

[0012] The positive pole terminal for presenting charge and discharge is set to 1, a negative pole terminal is set to 2, the series connection of the group P1 which carried out multiple connection of a total of two with the cells 3a and 3b, the group P2 with the similarly connected cells 3c and 3d, the group P3 with the cells 3e and 3f, and the group P4 with the cells 3g and 3h is carried out, and they are constituted. That is, it is the composition which carries out the series connection of the m group of the group which carried out multiple connection of the n cells which do not contain a series connection part in the case of the combination (2 or more [m and n]) of m series and n parallel.

[0013] Next, the charge-and-discharge cycle test of this example article and a conventional example article is explained. Seven pieces use cell composition of this example article and a conventional example article as a normal article (also open circuit voltage and internal resistance less than average value $\times 3\sigma$) at the time series and before connecting in parallel. Remaining one piece is used as an unusual article (a part for 4σ [A part for 4σ / Open-circuit-voltage unusual article average value of a normal article / a low thing and an internal resistance unusual article] high thing), and in this example article, it carries out to 3a of drawing 1, arranges and connects in a conventional example article to 13a of drawing 2, and is considered as a cell group. The lower limit voltage to a cell group was set as 10v, upper limit voltage was set as 16.8v, and the charge-and-discharge cycle test was done among such voltage. The charge-and-discharge cycle life of an example article and a conventional example article is shown in (Table 1). If it is this example article, in order to show that it is not inferior to the charge-and-discharge cycle life only in the case of a normal article by a charge-and-discharge cycle life when an unusual article is intermingled, either, the charge-and-discharge cycle test of the example article and conventional example article which comprises only a normal article is done similarly, and those charge-and-discharge cycle lives are also shown in (Table 1). The numerical value in front is average value of the test number 5.

[0014]

[Table 1]

	計 8 個の単電池 の構成内容	充放電サイクル寿命	
		放電容量が2サイクルめ の70%に低下し始めた サイクル数	実施例の正常 品のみに対す る比較指数
実施例 の 組電池	正常品のみ	282	100
	開路電圧異常品 1個含む	271	96
	内部抵抗異常品 1個含む	276	98
従来例 の 組電池	正常品のみ	196	70
	開路電圧異常品 1個含む	54	19
	内部抵抗異常品 1個含む	93	33

[0015]this (Table 1) – from – compared with the cell group according [the cell group by this example] to a conventional example, the effect outstanding in respect of the charge-and-discharge cycle life is acquired so that clearly. Although the contents of (Table 1) compared the charge-and-discharge cycle life with composition conventionally in the combination of 4 series and 2 parallel at this example, the same effect was acquired also in the combination of 2 series and 2 parallel, or the combination of 2 series and 4 parallel. Even when a mixing part was changed to P2 of drawing 1, P3, and P4 and one unusual article was mixed about the combination of 4 series and 2 parallel, the same effect was acquired irrespective of the mixing part.

[0016]Next, overcharge depth and overdischarge depth are shown in (Table 2). The cell with which it overcharged most or its multiple connection group of the class cell in charge of eye 50 cycles of the charge-and-discharge cycle test of (Table 1) these, The voltage of a part which exceeded 4.2v which is the upper limit voltage per cell (upper-limit-voltage 16.8v/to a cell group in-series several 4), The cell by which overdischarge was carried out most or its multiple connection group of the class cell in discharge of eye 50 cycles is shown by the voltage of the part which exceeded 2.5v which is the lower limit voltage per cell (lower-limit-voltage 10v/to a cell group in-series several 4). that is, the numerical value in front – 4.2v – what v – until overcharge was carried out highly – 2.5v – what v – it is shown whether until overdischarge was carried out low. The numerical value in front is average value of the test number 5 Table 1 Similarly.

[0017]

[Table 2]

	計 8 個の単電池 の構成内容	過充電深度 (v)	過放電深度 (v)
実施例 の 組電池	正常品のみ	0.00	0.25
	開路電圧異常品 1 個含む	0.03	0.31
	内部抵抗異常品 1 個含む	0.01	0.27
従来例 の 組電池	正常品のみ	0.08	0.60
	開路電圧異常品 1 個含む	0.25	1.52
	内部抵抗異常品 1 個含む	0.17	1.19

[0018]this (Table 2) – from – the cell group by this example so that clearly, Compared with the cell group by a conventional example, the effect excellent in the point which can make shallow overcharge depth of the cell with which it overcharged most, and overdischarge depth of the cell by which overdischarge was carried out most is acquired, and the effect outstanding in respect of the charge-and-discharge cycle life by this is acquired.

[0019]

[Effect of the Invention]By composition of this invention, intermingled depth of the surcharge and overdischarge of an unusual article can be made shallower than the intermingled conventional unusual article, and, therefore, the charge-and-discharge cycle life of an unusual article can be prolonged. Therefore, even when an unusual article is intermingled, the charge-and-discharge cycle life of the whole cell group can be prolonged conventionally, and the charge-and-discharge cycle life of the cell group which comprises only a normal article can be made to approach.

[0020]Since the open circuit voltage of a cell and dispersion of internal resistance have occurred within average value**3sigma at the time before connection even if comrades compare, when it comprises only a normal article, By the same operation, a charge-and-discharge cycle life can also be conventionally prolonged by about 1.4 times so that clearly from the result of (Table 1).

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CLAIMS

[Claim(s)]

[Claim 1]A cell group which is a cell group which connects an item of a nonaqueous secondary battery [lithium ion] using a dope and a carbonaceous material which can be dedoped as negative electrode active material, and is characterized by carrying out the series connection of the plurality of a multiple connection group of said item which does not contain a series connection part.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The hookup drawing of the cell in which the composition of one example of the cell group of this invention is shown

[Drawing 2]The hookup drawing of the cell in which the composition of the conventional cell group is shown

[Description of Notations]

1 Positive pole terminal

2 Negative pole terminal

3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, a cell

P1, P2, P3, and P4 Multiple connection group of a cell

11 Positive pole terminal

12 Negative pole terminal

13a, 13b, 13c, 13d, 13e, 13f, 13g, and 13h Cell

S1 and S2 Series-connection group of a cell

[Translation done.]

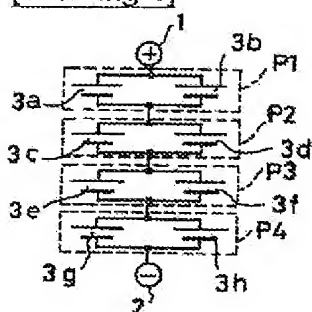
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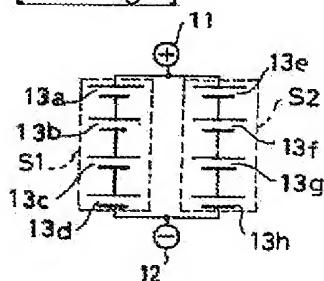
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DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]